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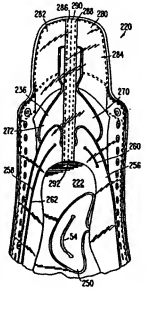
(54) Athletic shoe.

(57) A customized fit shoe comprising:
a sole;
an upper attached to said sole;
arch chamber means (250) inflatable to contour to the arch area of a wearer's foot;
malleoli chamber means attached to and positioned inside of said upper and inflatable to contour to the area directly below the malleoli of a wearer's foot; and
valve means for adjusting the air pressure in said arch chamber means and said malleoli chamber means to provide a customized fit for a wearer's foot.

FIG. 20.



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TECHNICAL FIELD

The present invention relates to athletic shoes and, more particularly, to athletic shoes wherein the upper extends around the ankle bones, such as in high top basketball shoes or high top skates. The invention is also directed to systems which customize the fit of the upper around the ankle bones by means of a pressurized collar.

BACKGROUND OF THE INVENTION

Current athletic shoes are a combination of many elements which have specific functions, all of which must work together for the support and protection of the foot during an athletic event. The shoes are designed to provide a unique and specific combination of traction, support, and protection to enhance athletic performance. Shoes are designed for specific sports, and are also designed to meet the specific characteristics of the user. For example, athletic shoes are designed differently for heavier persons than for lighter persons; differently for wide feet than for narrow feet; differently for high arches than for lower arches, etc. Some shoes are designed to correct physical problems, such as over-pronation, while others include devices, such an ankle supports, to prevent physical problems from developing.

An athletic shoe is divided into two general parts -- an upper and a sole. The sole is attached to the bottom of the upper and provides traction, protection, and a durable wear surface. The upper is designed to snugly and comfortably enclose the foot. In a running or jogging shoe, the upper typically terminates below the ankle bones and will have several layers including a weather and wear resistant outer layer of leather or synthetic material, such as nylon, and a soft padded inner liner for foot comfort. In athletic shoes designed for sports which require the athlete to make sudden and rapid lateral movements, such as in basketball, football, tennis or ice hockey, the upper frequently extends up to or above the ankle bones (the medial and lateral malleoli). Such shoes are referred to as three-quarter height or high top shoes.

Attaining a proper fit around the ankle bones in three-quarter height and high top athletic shoes has been a problem because the uneven contour around the ankle bones varies from person to person. The typical prior art technique for fitting the upper around the ankle bones has been to line the ankle portion of the upper with a relatively soft foam material. However, since no two persons have precisely the same ankle bone configuration, the foam material only approximates a customized fit.

The use of adjustable air-inflated bladders in the ankle portion of an upper is also found in the prior art. The most frequent use of such bladders is found in ski boots wherein the upper is relatively inflexible and the air bladders are designed to embrace the ankle and lower leg and provide a restraining force against the foot. Such air bladders typically form rigid vertical columns along the medial and lateral sides of the foot and leg, thereby restricting movement of the foot. While such restriction of motion is desirable in a ski boot, it interferes with required foot motion in athletic shoes designed for athletic activities such as basketball, football and tennis. West German Patents 2,365,329 and 2,308,547 disclose examples of such air bladders used in a ski boot. As seen in Figures 4 and 5 of these patents, a separate tongue bladder and ankle bladder are provided, with the ankle bladder having cut out areas avoiding the malleoli and achilles tendon. However, as is typical in ankle bladders used in prior art ski boots, the ankle bladder forms relatively rigid vertical columns.

U.S. Patent 3,758,964 relates particularly to ski boots and shows a bag member enclosed therein. Two chambers A and B are illustrated in Figure 16 of the '964 patent. Chamber B forms an uninterrupted column of pressurized gas from the top to the bottom on both the medial and lateral sides; it also completely covers the malleoli. Chamber A, while not extending the entire vertical height, does form a restrictive column adjacent the malleoli. A different configuration for chambers A and B is depicted in Figure 17 of the '984 patent. Chamber B therein forms a less substantial vertical column, but one would still form along the outer perimeter, anterior of the malleoli. Chamber A also forms a vertical column posterior to the malleoli. Figure 18 of this patent shows two small chambers B and a large chamber A. While chambers B cover the malleoli thereby restricting movement, chamber A forms vertical columns posterior to the malleoli. These vertical columns are formed near the malleoli and thereby have a stiffening effect which restricts plantar and dorsi flexion of the foot. Although these restrictive vertical columns in covering of the malleoli are preferred for activities such as skiing where the foot must be secured in the boot, they actually reduce the athlete's performance in sports such as basketball, football, soccer, tennis and running.

Examples of other shoes having bladder or similar arrangements include those in U.S. Patents 1,313,924, 2,086,389, 2,365,807, 3,121,430, 3,469,576 and 4,381,969, as well as that in French 1.406.610 patent. Some of these designs include bladder placement which actually interferes with the fit of the foot in the shoe, some are not volume or pressure adjustable to provide a customized fit, some interfere with cushioning components of the

shoe, some restrict the movement of the foot, and some interfere with the pronation/supination action of the foot. None of them meets today's rigorous athletic standards, and none of them is especially well-suited for use in high top ice skates.

SUMMARY OF THE INVENTION

The present invention is directed to an athletic shoe comprised of a sole and an upper attached to the sole. The upper includes an ankle portion extending around at least a portion of the area of the medial and lateral malleoli. An inflatable bladder is attached within the ankle portion of the upper and has a medial section, a lateral section and an inlet mechanism for supplying pressurized gas to the interior of the bladder. A mechanism is incorporated into both the medial and lateral sections of the bladder for preventing the formation of restrictive vertical columns of pressurized gas in the medial and lateral sections.

In a preferred embodiment, the inflatable bladder is formed of two separate sheets or layers of elastomeric film connected to one another around the perimeter of the bladder. Polyurethane can be used, and it is also within the scope of the invention to make the bladder by blow molding. The medial and lateral sections of the bladder are both divided into upper and lower chambers by connection lines between the sheets of elastomeric film. The connection lines form the prevention mechanism and extend generally horizontally in each of the medial and lateral sections substantially along the entire horizontal extent of the lateral and medial sections in the area of the lateral and medial malleoli, respectively.

The medial and lateral sections of the inflatable bladder each have edges defining a cut out area. Each cut out area surrounds the area of a respective malleoli so that the medial and lateral malleoli are not covered by the inflatable bladder.

An athletic shoe incorporating the inflatable bladder of the present invention takes advantage of the adjustability of an inflatable bladder which can adapt itself to various ankle and leg configurations when pressurized, thereby providing a customized fit around any ankle. However, this advantage is obtained while alleviating the disadvantage of the rigidity found in prior art air bladders which formed relatively stiff vertical columns on either side of the ankle. Thus, the athletic shoe of the present invention can be comfortably worn in athletic activities such as basketball, football and tennis, which require a high degree of flexibility for plantar and dorsi flexion.

One embodiment of the present invention is particularly directed to high top ice skates. The upper thereof includes an ankle portion extending around at least a portion of the area of the medial and lateral malleoli. One or more malleoli chambers are positioned in this shoe to fill in the areas below the malleoli. One or more arch chambers are positioned at the arch area in the shoe. Upper heel chambers fill in the areas behind and slightly above the malleoli. Each of these chambers is pressure adjustable through a valve stem accessible from outside the shoe. When inflated these chambers contour to the concavities of the foot adjacent the malleoli and at the arch without restricting the plantar or dorsi flexion of the foot.

Various advantages and features of novelty which characterize the invention are pointed out with particularity in the claims annexed hereto and forming a part hereof. However, for a better understanding of the invention, its advantages, and objects obtained by its use, reference should be had to the drawings which form a further part hereof and to the accompanying descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a lateral side view of an athletic shoe of the present invention illustrating the inflatable bladder thereof in dash line.

Figure 2 is a top plan view of the athletic shoe, partially broken away, illustrating the inflatable bladder between an outer layer and inner liner of the upper.

Figure 3 is a perspective view of the inflatable bladder connected to a hand pump.

Figure 4 is a plan view of the inflatable bladder extended flat, with portions of a foot and leg anatomy shown diagrammatically in phantom line.

Figure 5 is a perspective view illustrating in isolation a hand pump.

Figure 6 is a perspective view illustrating in isolation an alternative bladder and valve assembly of the present invention.

Figure 7 is a cross-sectional view taken along line 7-7 of Figure 6.

Figure 8 is a side elevetional view of an alternative valve assembly which can be used for example on the bladders of Figures 3, 4 or 6.

Figure 9 is a view taken on line 9-9 of Figure 8.

Figure 10 is a view taken on line 10-10 of Figure 8.

Figure 11 is an interior end view of a pump nozzle of the hand pump of Figure 5.

Figure 12 is a cross-sectional view taken along line 12-12 of Figure 11.

Figure 13 is an end view of the opposite end of the nozzle of Figure 5.

Figure 14 is an end view of an alternative preferred outlet for the hand pump of Figure 5.

Figure 15 is a cross-sectional view taken along line 15-15 of Figure 14 of an alternative preferred outlet end for the hand pump of Figure 5.

Figure 18 is a side elevational view of a shoe, particularly a high top ice skate, of the present invention which includes an alternate embodiment of a novel inflatable bladder system.

Figure 17 is a side elevational view of the opposite side of the shoe of Figure 16.

Figure 18 is a rear elevational view of the shoe of Figure 16.

Figure 19 is a top plan view of the sole of the shoe of Figure 16 and a portion of the bladder system thereon, illustrated in isolation.

Figure 20 is a top perspective view of the forward portion of the shoe of Figure 16, with the tongue thereof pulled forward to more clearly illustrate the bladder system therein.

Figure 21 is a plan view of the inflatable bladder system of the shoe of Figure 16 shown extended flat and in isolation.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

Referring to the drawings, wherein like numerals indicate like elements, there is illustrated in Figures 1 and 2 an athletic shoe 10 in accordance with the present invention. Shoe 10 includes a sole 12 attached in a conventional manner, for example, by an adhesive, to an upper 14. Shoe 10 is preferably a high top type of athletic shoe wherein upper 14 extends around and above the medial and lateral malleoli, indicated as M in Figures 1 and 4. Sole 12 is a cup-type sole wherein a portion of the sole extends around the sides of upper 14. Upper 14 includes a toe portion 16, extending around the area of the toes, an instep portion 18 extending around the instep portion of the foot and including lacing eyelets 20 and an ankle portion 22 extending around the ankle and lower leg. Ankle portion 22 also includes lacing eyelets 20 and a tightening strap 24.

An inflatable bladder 30 is attached to ankle portion 22 of upper 14. Details of bladder 30 are best seen in Figures 3 and 4. Bladder 30 is formed of two separate sheets or layers of elastomeric film, an inside layer 32 and an outside layer 34, which are sealed together along their perimeter edges 36. Bladder 30 has a medial section 38, a lateral section 40, and a small rear section 42 in fluid communication between the medial and lateral sections. Medial section 38 is divided into an upper portion 44 and a lower portion 48 by a divider formed of a weld line 48 connecting inner and outer layers 32 and 34. Lateral section 40 is similarly divided into an upper portion 50 and a lower portion 52 by a divider formed of a weld line 54 connecting inner and outer layers 32 and 34.

When bladder 30 is incorporated into ankle portion 22, weld line 48 is in vertical alignment with the area of the medial malleoli M as shown diagrammatically in Figure 4, and weld line 54 is vertically allgned with the area of lateral malleoli M, also as illustrated in Figure 4. Similarly, as illustrated diagrammatically in Figure 4, perimeter 36 on the medial side defines a cut out area 56, approximately between dash lines 57, which surrounds the area of the medial malleoli so that the bladder does not cover the medial malleoli. On the lateral side, perimeter 36 also defines a lateral cut out area 58, approximately between dash lines 59, which surrounds the area of the lateral malleoli so that bladder 30 does not cover or extend over the lateral malleoli.

A lowermost edge 60 of rear section 42 is located above the achilles tendon area, indicated diagrammatically as A in Figure 4, and the medial and lateral sections 38, 40 have rearward edges 62 and 64 disposed to the sides of achilles tendon area A so that no portion of inflatable bladder 30 overlies the achilles tendon.

Weld lines 48 and 54 function as dividers in the medial and lateral sections and perform the critical function of preventing the formation of vertical columns of pressurized gas on the medial and lateral sides. Such pressurized vertical columns would unduly restrict the motion of the foot and ankle. To perform this function, medial weld line 48 extends horizontally along substantially the entire extent of medial section 38 in the area of medial malleoli M so that only small areas of fluid communication 66 remain between upper and lower portions 44 and 46. Similarly, weld line 54 extends horizontally along substantially the entire width of lateral section 40 in the area of the lateral malleoli so that only small fluid communication areas 66 exist between upper and lower portions 50 and 52. These small areas 66 are insufficient to allow the formation of rigid vertical columns of pressurized air.

As seen in Figure 3, bladder 30 is bent in a generally U-shaped configuration for incorporation into ankle portion 22. In order to inflate bladder 30 a pump, such as hand pump 68, is connected to a valve 70 extending from rear section 42 and ambient air is pumped through valve 70. Inflatable bladder 30 is incorporated into ankle portion 22 between an outer layer 80 of the upper and an inner liner 82 of the upper. A portion of outer layer 80 of the upper, in the area indicated generally by dot-dash line 75 can be formed into a pre-shaped shroud from a relatively high density foam material and may include an aperture 76 through which valve 70 extends and can be accessed by hand pump 68. Since the shroud is formed of a high

density foam material, for example .2 -.4 gm/cm^3, it takes on a relatively fixed, but flexible configuration. When inflated by hand pump 68, medial and lateral sections 38 and 40 expand to fill in the areas surrounding the medial and lateral malleoli to provide a comfortable fit for the high-top portion of the upper. However, since weld lines 48 and 54 prevent the formation of pressurized vertical columns, plantar and dorsi flexion are not restricted.

A preferred hand pump 68 of the present invention is illustrated in isolation in Figure 5 generally at 100. It is seen therein to include a pump body 102 of a flexible plastic material which can be easily grasped and controllably compressed by a hand squeeze and when the pressure of the hand squeeze is released returns to its normal expanded position. The body 102 further includes a bumpy and raised lower surface 104 providing a friction surface to be easily held in the user's hand. When the pump body 102 is compressed, air in the body is expelled or forced out of the outlet end 106. When it is subsequently released, the air is sucked in through the opposite inlet end 108.

Both inlet and outlet ends 108, 106 include internal sliding rods which slide within their nozzle housings between open and closed positions relative to their openings as needed for the pumping action. A sample valve housing for the outlet end 106 and in which the outlet rod slides is shown in isolation in Figures 11-13 generally at 110. When released, the outlet plug or rod, which is shown at 111 in Figure 12, is then sucked or drawn inward to a position spaced from the prongs 112 closing the opening. The prongs or cross-bars 112 provide an abutment surface for depressing the valve assembly shown generally at 114 to open it so that air can be injected into the bladder 116. Similarly, the sliding rod of the inlet end 108 slides to an open position when the pump body 102 is released to allow air to be sucked in through the opening. At that time the outlet end 106 is in a closed position by the outlet rod. When the body 102 is compressed, the sliding inlet rod is forced outwardly to close the inlet end 108 so that all of the expelled air pressure is expelled through the outlet end 106.

A bladder and valve assembly of the present invention is shown in Figure 6 generally at 117. Description of the bladder portion thereof shown generally at 116 is provided with respect to the embodiment illustrated in Figure 4. The construction and operation of the valve assembly 114 will now be described with reference to Figures 6 and 7 as well as a variation thereon as depicted in Figures 8-10, and differences between them will also be mentioned. In other words, valve assembly 114 can be substituted for or shows in greater detail valve 70. The valve assembly 114 uses a firm, but compliant, elongated housing 118 of urethane (Shore A80-90) which is compatible with the urethane film bladder 116. This compatibility allows it to be R.F. welded in place along the peripheral flange 120. The housing 118 has an air passageway 122 therethrough and in which is secured a spring-biased valve stem assembly shown generally at 124. This valve stem assembly 124 includes an aluminum valve stem 126 having a broad smooth tip 128 which is easy to manipulate with the user's finger tip. The tip 128 can either be rounded as shown in Figures 8 and 9 at 130 or have a flat surface 132 with a beveled edge 134 as best shown in Figure 7. The valve body or housing 118 has a conical-shaped seat area 136, and thus the molded valve housing advantageously functions as the valve seat. The inner end of the valve stem 126 defines an enlarged body member 138 having a flat surface 140. This flat surface-conical seat area, in contrast to a conical valve body head, allows for more sealing pressure to be applied and a more compliant spring to be used while still obtaining an adequate seal. This is important when the valve assembly is operated by a person's finger as is the present case.

The spring, as shown in Figures 6 and 8 at 142, encircles the valve stem 126 and can, for example, be a plated music wire compression spring having an outer diameter of 4.57 millimeters, a wire diameter of .36 millimeters, a free length of 12.7 millimeters and a spring rate of 0.49 kilograms per millimeter. When the broad smooth tip 128 of the valve stem 126 is manipulated or pressed down with a finger tip or by other means, the valve stem is pressed inwardly and the plunger end 138 moved inwardly away from the valve seat 136 allowing air to flow therethrough. The valve assembly 114 of Figures 6 and 7, unlike that of Figures 8-10, has an annular abutment shoulder 144, against which the end of outlet end 106 abuts when hand pump 100 is slipped into place on valve housing 118 for inflating bladder 116 (or bladder 30), as will be explained in greater detail in conjunction with Figures 14 and 15.

Thus, unlike standard freon or push-to-deflate valves which are designed to be held together by a crimped metal housing and then attached to a metal can, the valve of the present invention can be connected to the present urethane film bladder. The standard valve is further difficult and uncomfortable to release pressure therefrom by using only one's finger tip.

A standard tire or Schraeder valve, which uses a metal pin and rubber gasket assembly inside of a metal housing, has a valve stem which is somewhat easier to depress than is the push-to-deflate-valve. However, the metal housing of this valve is not readily combinable with the present urethane film, unlike the valve of the present invention.

A needle or Voit type of valve requires a needle to be inserted through a rubber stem for inflation and deflation procedures. This type of valve is difficult, however, to manipulate when a fine adjustment of pressure is desired, such as is required in the present footwear application. It is eiso difficult to regulate the amount of air released by the needle valve from the inflated object inasmuch as that valve is either fuily ciosed or fully open. The needle valve, however, can be mede in the material suitable for bonding or welding to a urethene bladder.

One way or check valves which allow flow in only one direction are commonly found in medical devices such as syringes and bulb pumps. A typical check valve has a hard outer housing of metal and plastic end a softer, rubber-like component which seals the valve when air pressure pushes against it. These valves, however, are not suitable for the present purposes since they cannot release air slowly and accurately and they act in only one direction.

Figures 11-13 illustrate one outlet nozzle of the present invention having a connector end (at the left of Figure 12) adapted to be attached to the body of the hand pump 100. An alternative and preferred outlet nozzle arrangement is iiiustrated in Figures 14 and 15. These two figures show the outlet end 106 of the hand pump 100 with a nozzle 150 built therein against the interior pump shoulder 152. The nozzle 150 defines a cylinder 154 in which piug 154 slides. When in an outward position the head 158 of plug 156 engages the four cross prongs 160. The cross prongs 160 extend radially inward and also angle outward relative to the axis of the cyllnder 154, as can be understood from Figures 14 and 15. The prongs 160 and the distal end 162 of the cyiinder define e seat 164. When the sleeve end 166 of the outlet end 106 is slipped onto and over the elongated housing 118 generally up to the abutment shoulder 144, the seat 164 impacts the tip 128. The valve stem assembly 124 is thereby depressed and the valve assembly 114 opened so that air can be injected by the hand pump 100 into the bladder 116.

Thus the disclosed valve and pump system is advantageous over the prior art systems because of the reduced number of parts needed. No connectors, extenders or the like are required, and no connecting hose between the pump and the valve is needed since the one-wey velve in the nozzle of the pump actuates the valve. A perfect air-tight seal therebetween is not necessary since the pressures and volumes involved are quite small as can be appreciated. Since the system has few moving parts, it is very reliable. Inflation and deflation of the bladder can be easily and accurately accomplished with the present system.

Figures 16, 17 and 20 illustrate an alternate embodiment of an athletic shoe shown generally at 220 in accordance with the present invention. Shoe 220 includes a sole 222 attached in a conventional manner to an upper 224. The shoe 220 is preferably a high top type of athletic shoe wherein the upper 224 extends around and ebove the mediai and lateral malleoli, indicated as M in Figure 21. The upper 224 includes e toe portion 226 extending around the area of the toes, an instep portion 228 extending around the instep portion of the foot and including lacing eyelets 230, and an ankle portion 232 extending around the ankle and lower leg. A skate blade 234, whose upper portions are depicted in Figures 18 and 17, can be secured beneath the sole 222 so that the shoe 220 thereby forms an ice skate.

An inflatable air bladder assembly shown for example in isolation in Figure 21 generally at 236 is attached inside of the shoe 220 to the upper 224. The bladder assembly 236 is formed of two separate sheets or layers of elastomeric film -- an inside layer 238 and an outside leyer -- which are sealed together along their perimeter edges 242. The air bladder assembly 236 includes a plurality of chambers inflatable to different degrees and positioned to correspond to different concavity areas of the foot. These chambers are connected by air passageways and separated by weld lines, and some are further divided into pockets or subchambers, as will be explained below, to further enhance the fit. Although the chambers are separate and can be inflated to different degrees to accommodate differently configured feet, they are inflatable through the same nozzle or valve stem as shown generally at 244 at the top of the bladder assembly 236. The nozzle or valve stem 244 is preferably of the type illustrated in Figures 6-10 and inflated by a pump such as illustrated in Figures 5 and 11-15. The valve stem 244 can be located, however, at generally any other convenient location on the shoe 220. It is also within the scope of this invention to provide independent valves for one or more of these chambers.

The valve stem 244 extends out the back of the shoe 220 to be accessible from outside of the shoe. A pre-shaped shroud 246 of a relatively high density foam material is secured to the upper 224 at the upper top portion of the shoe 220. The shroud 246 has an aperture therethrough through which the valve stem 244 extends to be accessed for inflation and deflation of the chambers of the bladder assembly 236. Since the shroud 246 is formed of a high density foam material, it takes on a relatively fixed, but flexible configuration. The amount of air and thus pressure in each of the chambers can be finely and accurately adjusted by inflating the bladder assembly 238 through the

valve stem 244 by gently squeezing the hand pump 100. Accurate deflation then can be made by lightly pressing, as with the finger tip or the opposite end of the hand pump 100, the push-to-deflate nozzle of valve stem 244. In lieu of air, any suitable free-flowing, non-setting fluid can be used to controllably adjust the size and pressure of the chambers.

The bladder assembly 236 is divided into a plurality of chambers, as can be seen for example in Figures 20 and 21. The arch chamber 250, as can also be seen in Figures 18 and 19, has its function augmented by the side arch chamber 252, which is positioned towards the medial side of the foot. These two chambers 250, 252 combine to completely fill in the arch area of the foot. A curved contouring weld 254 centrally positioned in the arch chamber 250 provides an additional contouring fit function. A pair of malleoli or lower heel chambers 256, 258 extend forward to the arch area along the sides of the foot. The malleoli or lower heel chambers 256, 258 are subdivided by contouring welds 260, 262 to provide a contoured filling in of the area of the foot below the malleoli. The heel chamber 256 is separated from the side arch chamber 252 by a contoured weld 264. Weld posts are provided at the free ends of the weld lines -- either a relatively small post as shown at 266 or a larger post as shown at 268 for the double or folded layer ends.

Upper heel chambers 270 and 272 for filling in the areas of the foot behind and slightly above the malleoli are provided at the top of the bladder assembly 236 below the valve stem 244. Umbilical passageway or tube 274 extends from the upper heel chambers 270, 272 to the malleoli or lower heel chambers 256, 258. Although this tube 274 is narrow enough to not actually or significantly inflate when the bladder assembly 236 is pressurized, it is wide enough to allow air to pass freely through it thereby communicating the various bladder chambers. The bladder assembly 236 thus fills in the cavities of the arch and ankle of the foot to enhance the fit of the shoe to the foot, rather than to cushion the foot. The bladder assembly 236 does not extend around the entire foot so as to interfere with the fit and particularly does not restrict the plantar and dorsi flexion of the foot. In other words, the numerous chambers within this bladder assembly 236 contour the bladder assembly to the anatomy of the foot without restricting the motion of the foot.

A plurality of tabs 278, 278a, 278b, 278c, 278d and 278e, as best shown in Figure 21, extend out from the chambers for stitching the bladder assembly 236 in place in the shoe 220 to the shoe upper 224, and are not themselves inflated. As seen in Figure 20, a liner 280, preferably a flexible, clear plastic liner, is secured to and in the upper 224 and positioned between the bladder assembly 236 and the foot. This liner 280 allows the foot to be easily slipped into and out of the shoe 220 without dislodging, damaging or getting caught up on any of the chambers of the bladder assembly 236. The liner 280 can be comprised of a pair of flexible sheets 282, 284 stitched along the edges of the upper 224 on both sides thereof. The rear vertical edges of the two sheets 282, 284 are stitched to one or two interconnected elongated webs 286, 288 secured at the top 290 and the bottom 292 of the upper 224 and not fixed along their lengths to the upper 224 so as to not restrict the inflating and deflating movement of the enclosed bladder assembly 236.

Alternatively, this bladder assembly 236 can be molded in place in a polyurethane or latex sockliner or adhered to an EVA or PEEVA liner. Fabric or foam can be applied to the inner surfaces of the chambers to provide slip resistance and comfort to the foot as when a plastic liner is not used. The bladder assembly 236 can be attached to the bottom of a foam sockliner. The heel area and the forefool area can be left completely exposed to prevent this assembly from interfering with the cushioning of the foot.

Numerous characteristics and advantages of the invention have been described in detail in the foregoing description with reference to the accompanying drawings. However, the disclosure is illustrative only and the invention is not limited to the precise illustrated embodiment. Various changes and modifications may be affected therein by persons skilled in the art without departing from the scope or spirit of the invention. For example, the bladder could be used in a three-quarter height shoe wherein the ankle portion of the upper extends only partially over, or only slightly above, the medial and lateral malleoli.

It will be appreciated that another aspect of the invention provides a method of customizing the fit of a shoe to a wearer's foot. The method comprising the steps of:

providing a shoe having interior arch and malleoli bladder compartments;

placing a foot in the shoe; and

thereafter, adjusting the pressure in the arch and malleoli bladder compartments to better fit the shoe to the contours of the arch and the area directly below the malleoli of the foot in the shoe and without thereby restricting plantar or dorsi flexion of the foot.

The adjusting step can include adjusting the pressure of the bladder throughout the entire arch area of the foot where the shoe has an interior upper heel bladder compartment, the adjusting step can include adjusting the pressure in the

upper heel bladder compartment to conform to the contour of the area of the foot behind and slightly above the malleoli. The adjusting step can include adjusting the pressure in the arch and malleoli bladder compartments through a push-to-deflate valve directly communicating with the upper heel bladder compartment.

Claims

1. A customized fit shoe comprising:
   a sole;
   an upper attached to said sole;
   arch chamber means inflatable to contour to the arch area of a foot on said sole;
   malleoli chamber means attached to and positioned inside of said upper and inflatable to contour to the area directly below the malleoli of the foot on said sole; and
   valve means for adjusting the pressure in said arch chamber means and said malleoli chamber means to provide a customized fit for individual feet.

2. A shoe in accordance with claim 1 wherein said valve means includes a valve accessible from outside of said upper for adjusting the pressure in at least one said arch chamber means and said malleoli chamber means, and/or
   said valve means includes a valve communicating with, for inflating, both said arch chamber means and said malleoli chambers means, and/or
   said valve means includes a valve for inflating said arch chamber means, and/or
   said valve means includes a valve for inflating said malleoli chamber means, and/or
   said arch chamber means includes a plurality of chambers individually inflatable through said valve means, and/or said plurality of chembers includes a side arch chamber and an arch chamber, together completely filling in the entire arch area of a wearer's foot, and/or said arch chamber lies generally on said sole and said side arch chamber is positioned generally adjacent said upper, and/or said arch chamber includes a central contour weld.

3. A shoe in accordance with claim 1 or 2 further comprising heel chamber means positioned inside of said upper and inflatable by said valve means to contour to the portion of a wearer's foot behind and slightly above the malleoli, and/or
   wherein said heel chamber means includes a pair of side-by-side heel chambers and at least one contouring weld therebetween, and/or
   further comprising a non-inflatable air passageway through which air passes between said heel chamber means and said malleoli chamber means, and/or
   wherein said malleoli chamber means extends forward along the sides of the foot to the arch area.

4. A shoe according to claim 1, 2 or 3, further comprising a plurality of tabs attached to at least one said malleoli chamber means and said arch chamber means for securing at least one said malleoli chamber means and said arch chamber means to said upper, and/or
   further comprising passagewey means for communicating said malleoli chamber means end said arch chamber means such thet air can pass therebetween and to and from said valve means, and/or
   further comprising a skate blade depending down from said sole, and/or
   wherein said malleoli chamber means when inflated to a wearer's foot contour does not interfere with the pronation or supination of the foot, and/or
   wherein said malleoli chamber means and said arch chamber means when contour inflated to a wearer's foot do not restrict plantar or dorsi flexion of that foot, and/or
   wherein said valve means allows fine adjustment of the air pressure in said arch chamber means and said malleoli chamber means between generally fully inflated and deflated conditions and a continuum of conditions therebetween, and/or
   further comprising a flexible liner attached to said upper and covering said arch chamber means and said malleoli chamber means and against which a wearer's foot is operatively disposed.

5. A shoe comprising:
   a sole;
   an upper attached to said sole;
   bladder means for customizing the fit of the shoe, said bladder means including an inflatable arch chamber means to contour to the arch area of a wearer's foot;
   valve means for adjusting the pressure in said arch chamber means to provide a customized fit for the plantar area of the arch of a wearer's foot; and
   said arch chamber means including a bottom arch chamber generally on said sole and underlying the plantar arch area, said bottom arch chamber being formed of layers of elastomeric material joined around the perim-

eter of said bottom arch chamber, and said bottom arch chamber including a contouring weld in the interior of said bottom arch chamber connecting said layers of material to contour the fit of said bottom arch chamber to the plantar surface in the medial arch area of a wearer's foot when said bottom arch chamber is pressurized with gas.

6. A shoe in accordance with claim 5 wherein said arch chamber means further includes a side arch chamber positioned adjacent said upper along the medial side of said upper in the area of the arch of the foot, and said bottom arch chamber being partially separated from said side arch chamber in the area between the sole and the upper and in fluid communication with said side arch chamber, said side arch and bottom arch chambers together filling in the entire medial arch area of a wearer's foot.

7. A shoe comprising:

a sole;

an upper attached to said sole;

bladder means for customizing the fit of the shoe, said bladder means including heel chamber means, malleoli chamber means, and valve means;

said heel chamber means being attached to and positioned inside of said upper and inflatable to contour to the portion of a wearer's foot behind and slightly above the malleoli;

said malleoli chamber means being attached to and positioned inside of said upper and inflatable to contour to the area directly below the malleoli;

said valve means being accessible from outside of said upper for adjusting the pressure in said heel chamber means and said malleoli chamber means to provide a customized fit for a wearer's foot;

said heel chamber means including medial and lateral heel chambers positioned behind and slightly above the medial and lateral malleoli;

said malleoli chamber means including medial and lateral malleoli chambers positioned below the medial and lateral malleoli; and

a passageway positioned at the back of the heel area and between said medial heel and malleoli chambers and said lateral heel and malleoli chambers to provide fluid communication between said heel chamber means and said malleoli chamber means, said passageway having a width sufficient to allow fluid to pass freely through it but insufficient to expand significantly whereby an expanded chamber does not impinge on the area at the back of the heel.

8. A shoe in accordance with claim 7 wherein said heel chamber means is formed of layers of elastomeric material connected around the outer perimeter of said heel chamber means to define said medial and lateral heel chambers; and said malleoli chamber means is formed of layers of elastomeric material connected around the outer perimeter of said malleoli chamber means to define said medial and lateral malleoli chambers, a portion of the outer perimeters of said medial heel and malleoli chambers being adjacent to and separate from one another, and a portion of the outer perimeters of said lateral heel and malleoli chambers being adjacent to and separate from one another, to thereby prevent the formation of restrictive columns of pressurized gas between adjacent heel and malleoli chambers.

9. A shoe in accordance with claim 7 or 8 wherein said bladder chamber means includes:

arch chamber means inflatable to contour to the arch area of a foot on said sole;

said arch chamber means including a bottom arch chamber generally on said sole and underlying the plantar arch area, said bottom arch chamber being formed of layers of elastomeric material joined around the perimeter of said bottom arch chamber, and said bottom arch chamber including a contouring weld in the interior of said bottom arch chamber connecting said layers of material to contour the fit of said bottom arch chamber to the plantar surface in the medial arch area of a wearer's foot when said bottom arch chamber is pressurized with gas.

10. A shoe in accordance with claim 9 wherein said arch chamber means further includes a side arch chamber positioned generally adjacent said upper along the medial side of said upper in the area of the arch of a wearer's foot and said bottom arch chamber being partially separated from said arch chamber in the area between the sole and the upper and in fluid communication with said side arch chamber, said side arch and bottom arch chambers together operatively filling in the entire medial arch area of a wearer's foot.

11. An athletic shoe in accordance with any of claims 1 to 10 wherein said valve means includes a valve located in a rear section of said bladder, said rear section being located behind

and in fluid communication with said medial and lateral sections, and/or

wherein said rear section has a lowermost edge located above the area of the achilles tendon, and/or

wherein said inflatable bladder is secured in said ankle portion of said upper between an outer layer of the upper and inner liner of the upper, and/or

wherein at least a portion of the outer layer of said upper within which said inflatable bladder is secured is formed as a shroud having a generally fixed shape, and/or

wherein said shroud is formed of a relatively high density plastic foam material, and/or

wherein an ankle portion of said upper extends completely around and above the area of the medial and lateral malleoli, and/or

wherein said valve means includes a valve located in a rear section of said bladder, said rear section being located behind and in fluid communication with medial and lateral sections of the bladder, and/or

wherein said rear section has a lowermost edge located above the area of the achilles tendon, and/or

wherein said inflatable bladder is secured in said ankle portion of said upper between an outer layer of said upper and inner liner of said upper, and/or

wherein at least a portion of the outer layer of said upper within which said inflatable bladder is secured is formed as a shroud having a generally fixed shape, and/or

wherein said shroud is formed of a relatively high density, plastic foam material, and/or

wherein said ankle portion extends completely around and above the area of the medial and lateral malleoli.

FIG. 1.

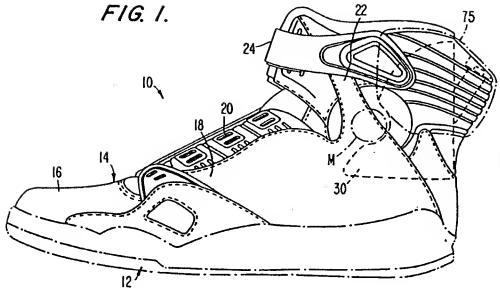

FIG. 2.

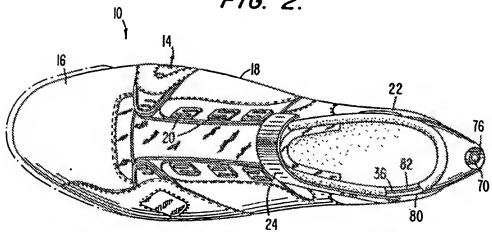

FIG. 3.

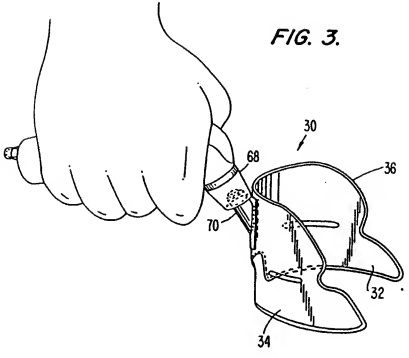
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FIG. 4.

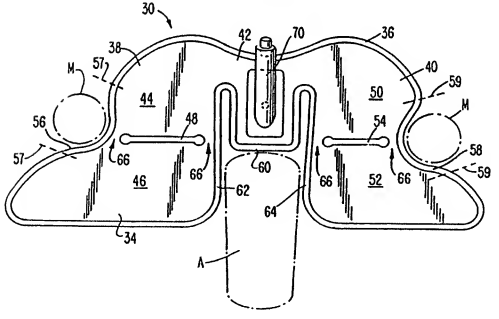
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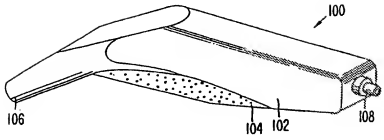
FIG. 5.



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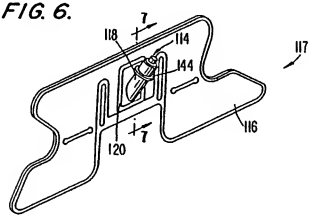

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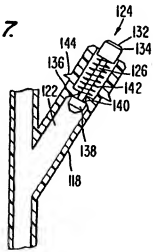

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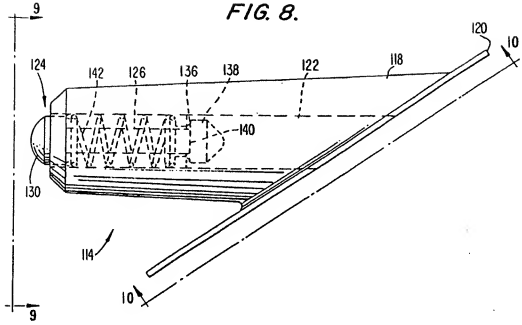
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FIG. 9.

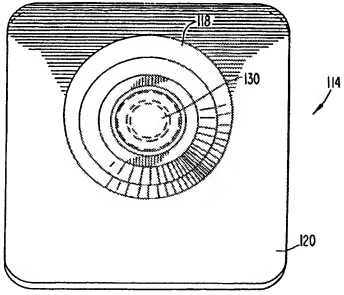
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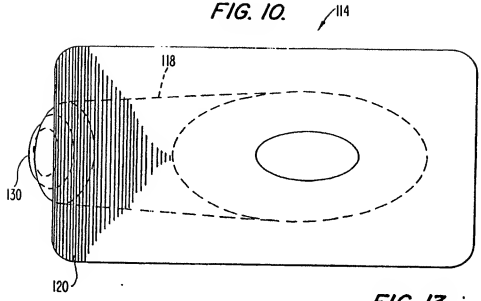
FIG. 10.



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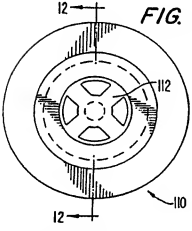

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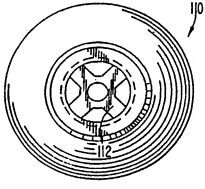

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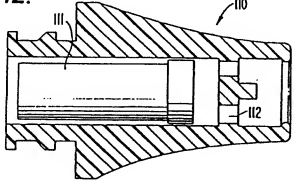
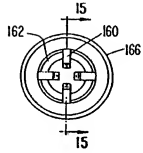


FIG. 14.



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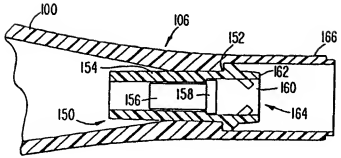
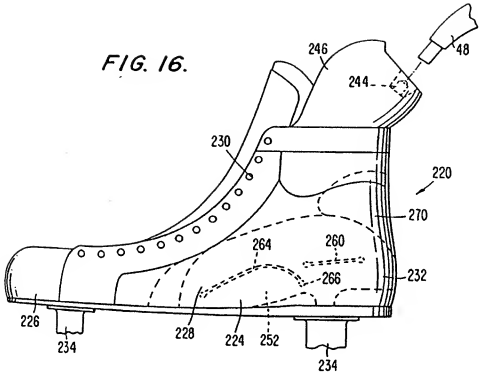


FIG. 16.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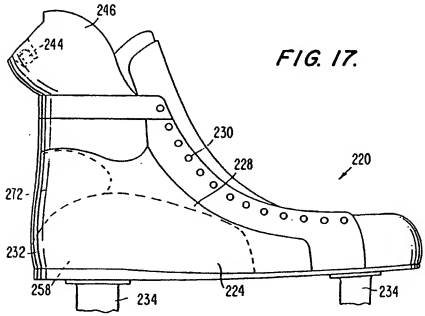
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FIG. 17.

FIG. 18.

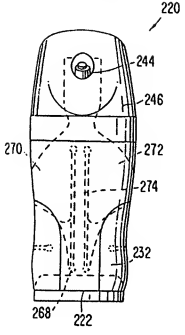


FIG. 20.

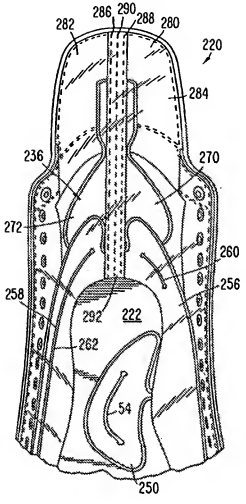
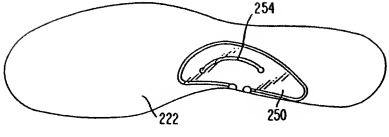


FIG. 19.



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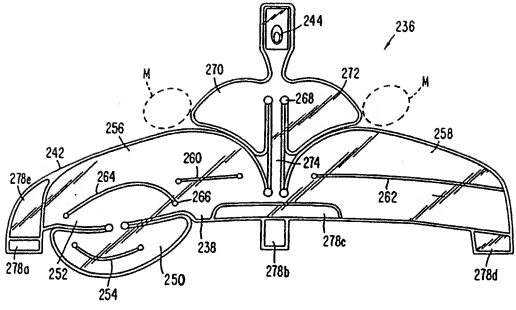
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